

Attorney's Docket No.: 10559-882001 /P17484  
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REMARKS

Claims 1-13 and 25-27 are pending. Claims 1, 10, and 25 are in independent form.

CLAIM 10

In the action mailed November 30, 2006, claim 10 was rejected under 35 U.S.C. § 102(b) as anticipated by European Patent Application No. 0915384 to Canon Kabushiki Kaisha (hereinafter "Canon"). This contention is respectfully traversed.

Claim 10 relates to a method that includes forming an interference pattern of non-exposed lines and exposed spaces on a photoresist, and exposing a portion of at least one line to radiation to form features with a second width. The lines have a first width. The second width is less than the first width. The pitch of the features is at least one and a half times the pitch of the interference pattern.

The rejection of claim 10 contends that FIGS. 11A-11D and 9A-9B of Canon describe exposing a portion of at least one line to radiation to form features with a second width that is less than the width of the non-exposed lines of the interference pattern. Applicant respectfully disagrees.

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As discussed in the response filed September 19, 2006, none of the exposure patterns in Canon have features with a width that is less than the width of the non-exposed lines of the interference pattern. With reference to Canon's FIGS. 11A-11D, FIG. 11A shows a periodic exposure pattern made through dual-beam interference exposure. This exposure pattern has a period of 0.2 micron and a line-and-space pattern with a 0.1 micron line width. See Canon, para. [0082]. For the sake of convenience, FIG. 11A is now reproduced.

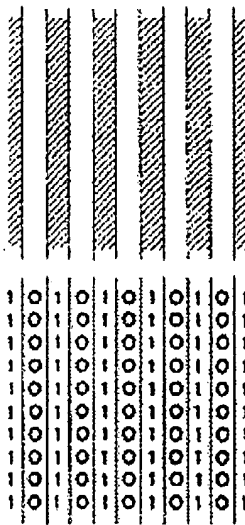


FIG. 11A

Please note that the "width of the non-exposed lines" in FIG. 11A is the width of the lines marked "0," i.e., 0.1 microns.

Canon's FIG. 11B shows the positioning and dosage of an exposure pattern defined using "ordinary projection exposure."

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The positioning is illustrated relative to the dual-beam interference exposure pattern. See Canon, para. [0101]. For the sake of convenience, FIG. 11B is now reproduced.

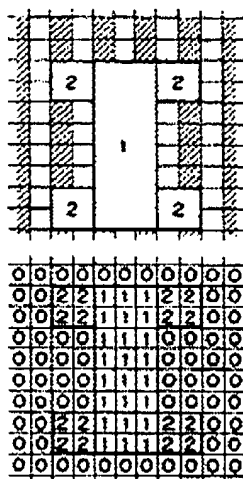
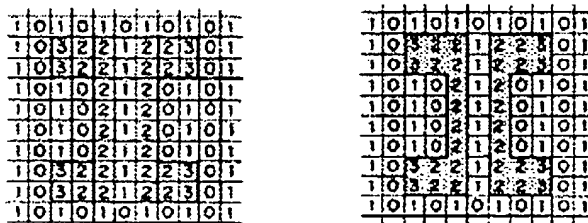


FIG. 11B

Please note that the smallest width of any portion of the "ordinary projection" exposure pattern is twice the width of the non-exposed lines in the interference exposure pattern, i.e., 0.2 microns.

Canon's FIG. 11C shows the positioning and dosage of an exposure pattern that results from the "accumulation or superposition" of the interference pattern of FIG. 11A and the "ordinary projection" exposure pattern of FIG. 11B. See Canon, para. [0105]. For the sake of convenience, FIG. 11C is now reproduced.



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Canon's "accumulation or superposition" pattern is thus the accumulation of the interference lithography pattern and the "ordinary projection exposure" pattern. Please note that the smallest width of any feature of the "accumulation or superposition" pattern is the width of the lines and spaces in FIG. 11A, i.e., 0.1 microns. This is perhaps not surprising, given that Canon's purpose in combining of interference lithography and "ordinary projection exposure" is to achieve the circuit pattern of FIG. 10. See Canon, para. [0104].

Since the smallest width of any feature in the "accumulation or superposition" pattern of FIG. 11A (i.e., 0.1 microns) is the same as the width of the non-exposed lines in FIG. 11A (i.e., 0.1 microns), Canon's FIG. 11A-11C neither describe nor suggest exposing a portion of at least one line to radiation to form features with a second width that is less than the width of the non-exposed lines of the interference pattern, as recited in claim 10.

FIGS. 9A and 9B also fail to describe or suggest exposing a portion of at least one line to radiation to form features with a second width that is less than the width of the non-exposed lines of the interference pattern, as recited in claim 10. From FIG. 9B, it is clear that the line width of the "accumulation or superposition" pattern is three times larger than the underlying

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lithographic exposure pattern of FIG. 5. See *Canon*, para. [0073]. No features with a second width that is less than the width of the non-exposed lines of the interference pattern are formed.

Accordingly, claim 10 is not anticipated by *Canon*. Applicant respectfully requests that the rejection of claim 10, and the claims dependent therefrom, be withdrawn.

CLAIM 25

Claim 25 was rejected under 35 U.S.C. § 103(a) as obvious over *Canon* and U.S. Patent No. 5,415,835 to Brueck et al. (hereinafter "*Brueck*").

Claim 25 relates to a method that includes using interference lithography to expose an interference pattern of non-exposed lines and exposed spaces on a photoresist, and using a second lithography process to trim and narrow a width of at least some of the non-exposed lines by exposing portions of the non-exposed lines using a second exposure having a second pitch. The interference pattern has a first pitch. The second pitch is different from the first pitch.

The rejection of claim 25 is based on the contention that it would have been obvious for one of ordinary skill to have combined *Canon* and *Brueck* to have arrived at the subject matter recited in claim 25.

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Applicant respectfully disagrees. In this regard, Canon describes a system that uses multiplex exposure amounts to produce a pattern. See, e.g., Canon, para. [0106]. Multiplex exposure amounts are achieved when three or more exposure levels (including zero level exposures) are used. This contrasts with the two exposure levels of a binary exposure levels system. See Canon, para. [0032]. FIGS. 8A, 8B, 9A, 9B of Canon illustrate Canon's use of multiple exposure levels. In particular, the exposure levels denoted "0" and "1" are below the threshold exposure level " $E_{th}$ " whereas the exposure levels denoted "2" and "3" are above the threshold exposure level " $E_{th}$ ." The threshold exposure level " $E_{th}$ " demarcates regions that print from regions that do not print. See, e.g., Canon, FIGS. 3A, 3B.

The demarcation between Canon's printing regions and non-printing regions is thus based on whether or not multiple exposures have been accumulated/superimposed upon each other. This is illustrated in Canon's FIGS. 11A-11C, which are discussed above. Canon's FIG. 11C shows the positioning and dosage of an exposure pattern that results from the "accumulation or superposition" of the interference pattern of FIG. 11A and the "ordinary projection" exposure pattern of FIG. 11B. See Canon, para. [0105]. The regions that have been exposed multiple times (i.e., the squares denoted "2" and "3")

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are demarcated from the regions that have never been exposed (i.e., the squares denoted "0") and the regions exposed once (i.e., the squares denoted "1").

Against this backdrop, the rejection of claim 25 contends that it would have been obvious for one of ordinary skill to turn to Brueck and use a second lithography process to trim and narrow a width of Canon's non-exposed lines by exposing portions of the non-exposed lines using a second exposure having a second pitch, as recited in claim 25.

Applicant respectfully disagrees. Canon uses the accumulation/superimposition of dosages from multiple exposures that demarcate printing from non-printing regions. An attempt to trim a non-exposed region (i.e., a "0" region) using a "1" exposure will still leave that region below Canon's threshold exposure level (i.e., at an exposure level "1"). Since Canon's "1" and "0" exposure levels are both below the threshold exposure level, they will both be printed or not printed together. Thus, there will be no trimming and narrowing of a width of at least some non-exposed lines, as recited in claim 24.

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Moreover, Brueck also fails to describe or suggest using a second lithography process to trim and narrow a width of at least some of the non-exposed lines of an interference pattern by exposing portions of the non-exposed lines using a second exposure, as recited in claim 24.

In this regard, Brueck describes that "complex, two-dimensional patterns" can be formed by single or multiple sets of interferometric exposures "in combination with conventional lithography techniques." See, e.g., Brueck, col. 2, line 38-46; col. 4, line 28-33.

With multiple interferometric exposures, Brueck describes that a substrate can be rotated (with or without concomitant changes in process parameters such as beam angle) so that the grating patterns cross and the net exposure patterns of FIGS. 8-14 are formed. See Brueck, col. 5, line 6 - col. 6, line 17. Applicant respectfully submits that such crossed grating patterns neither describe nor suggest the trimming and narrowing of a width of at least some of the non-exposed lines of an interference pattern, as recited in claim 24. In this regard, the patterns resulting from such crossed grating patterns are not trimmed and narrowed lines but rather the various shapes shown in FIGS. 8-14.



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As for conventional lithography techniques, Brueck describes that the entire width of a non-exposed line can be exposed using conventional lithography techniques. For example, the entire width of the non-exposed lines of the interference pattern of FIG. 16 can be exposed using the sequential exposures of FIGS. 17 and 18. See Brueck, col. 6, line 36-41. This yields the pattern of FIG. 19. See Brueck, col. 6, line 42-45.

Such an exposure of the entire width of a non-exposed line neither describes nor suggests the use of a second lithography process to trim and narrow a width of non-exposed lines by exposing portions of the non-exposed lines using a second exposure having a second pitch, as recited in claim 25. Rather, exposure of the entire width of a line removes the entire line.

Accordingly, claim 25 is not obvious over Canon and Brueck. Applicant therefore requests that the rejections of claim 25 and the claims dependent therefrom be withdrawn.

#### CLAIM 1

Claim 1 was rejected under 35 U.S.C. § 103(a) as obvious over Canon and Brueck.

Claim 1 relates to a system that includes a first apparatus to radiate an interference pattern of lines and spaces on a photoresist, and a second apparatus to radiate selected areas of the photoresist, and an alignment apparatus to align the

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selected areas radiated by the second apparatus with the interference pattern radiated by the first apparatus to trim and narrow the first width of at least some of the lines. The lines have a substantially equal first width and remain unexposed to radiation. The spaces are exposed to radiation. The selected areas expose portions of the lines to radiation. A pitch of the selected areas exposed by the second subsystem is at least one and a half times a pitch of the interference pattern.

The rejection of claim 1 is based on the contention that it would have been obvious for one of ordinary skill to have combined Canon and Brueck to have arrived at the subject matter recited in claim 1.

Applicant respectfully disagrees. In this regard, As discussed above, the demarcation between Canon's printing regions and non-printing regions is based on whether or not multiple exposures have been accumulated/superimposed upon each other. The regions that have been exposed multiple times are demarcated from the regions that have never been exposed and the regions exposed at levels below a threshold value.

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The rejection of claim 1 contends that it would have been obvious for one of ordinary skill to turn to Brueck to arrive at an alignment apparatus to align the selected areas radiated by a second apparatus with an interference pattern radiated by a first apparatus to trim and narrow width of at least some of the lines of the interference pattern, as recited in claim 1.

Applicant respectfully disagrees. In Canon, it is the accumulation/superimposition of dosages from multiple exposures that demarcate printing and non-printing regions in Canon. An attempt to trim a non-exposed region (i.e., a "0" region) using a "1" exposure will still leave that region below Canon's threshold exposure level (i.e., at an exposure level "1"). Since Canon's "1" and "0" exposure levels are both below the threshold exposure level, they will both be printed or not printed together. Thus, there will be no trimming and narrowing of a width of at least some non-exposed lines, much less an alignment apparatus as recited in claim 1.

Moreover, Brueck also fails to describe or suggest an alignment apparatus to align the selected areas radiated by a second apparatus with an interference pattern radiated by a first apparatus to trim and narrow width of at least some of the lines of the interference pattern, as recited in claim 1.

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In this regard, Brueck describes that "complex, two-dimensional patterns" can be formed by single or multiple sets of interferometric exposures "in combination with conventional lithography techniques. With multiple interferometric exposures, Brueck describes that a substrate can be rotated so that the grating patterns cross. Such crossed grating patterns neither describe nor suggest the trimming and narrowing of a width of at least some of the non-exposed lines of an interference pattern, as recited in claim 1.

As for conventional lithography techniques, Brueck describes that the *entire width* of a non-exposed line can be exposed using conventional lithography techniques. Such an exposure of the entire width of a non-exposed line neither describes nor suggests an alignment apparatus to align the selected areas radiated by a second apparatus with an interference pattern radiated by a first apparatus to trim and narrow width of at least some of the lines of the interference pattern, as recited in claim 1. Rather, exposure of the entire width of a line removes the entire line.

Accordingly, claim 1 is not obvious over Canon and Brueck. Applicant therefore requests that the rejections of claim 1 and the claims dependent therefrom be withdrawn.

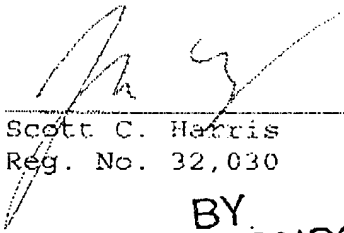
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It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

Applicant asks that all claims be allowed. No fees are believed due at this time. Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: February 28, 2007

  
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